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| 09/591,867 | 06/12/2000 | Tinku Acharya | 042390.P8746 | 4736 |

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| EXAMINER | |
|---|---|
| TRAN, NHAN T | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2615 | |

DATE MAILED: 09/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/591,867 | ACHARYA ET AL. | |
| | Examiner | Art Unit | |
| | Nhan T. Tran | 2615 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *15 July 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *8 and 10* is/are allowed.

6)☒ Claim(s) *1-7,9 and 11-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Response to Arguments*

1. Applicant's arguments filed 7/15/2005 have been fully considered but they are not persuasive.

On page 7 and 8 of the Applicant's remarks, the Applicants assert, "Bishay discloses using edge detection kernels to generate intensity values for the purposes of detecting edges but does not disclose using relative changes in intensity values to compute color signal values. Applicants respectfully assert that Bulman does not correct the deficiencies of Bishay in this regard."

In response, the Examiner respectfully disagrees with the Applicants. It is clearly shown in col. 2, lines 45-56, col. 4, lines 40-54 and col. 5, line 9 – col. 6, line 4 in Bishay that color signal values (missing color signal values) are computed during the interpolation process to obtain full color values at each pixel using hue-weighted intensity values of neighboring pixels. The choice of which neighboring pixels to use for the interpolation process is based on the values of four edge detection kernels applied to the current pixel. Bishay discloses that the computation for the missing color values including comparing relative changes in *intensity values* of neighboring pixels in each kernel to determine a direction having a strong correlation (or less relatively change) across the current pixel before applying hue-weighted interpolation to the current pixel (see Fig. 7 and col. 5, line 46 – col. 5, line 4). The only deficiency in Bishay is that Bishay does not teach *comparing relative changes in hue* across the current pixel (instead comparing relative changes in intensity values, see previous Office Action, page 3). This

deficiency is compensated by a suggestion in Bulman's reference, col. 15, lines 30-34, wherein characteristics of an object can be determined based on difference in brightness values (intensity values) or hue values. Thus, the Examiner submits that the combination of Bishay and Bulman has met the limitations of claims 1-7, 9, 11-20.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-7, 9, 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishay et al (US 6,507,364) in view of Bulman (US 6,351,265).

Regarding claim 1, Bishay discloses a method of using hue to interpolate color pixel signal values comprising:

for a particular pixel location in a subsampled image, comparing relative changes in intensity for two mutually orthogonal directions across said particular pixel location (X); and computing a color signal value (missing color value) for that particular pixel location for a color plane other than the color plane of the pixel signal value in the subsampled color image at that location, the computation including relatively weighing the relative changes in hue (hue-weighted values of neighboring pixels belonging to detected edge direction), the relative weights depending, at least in part, on the difference in *intensity value* in one particular direction relative

to the other. See Figs. 2-7; col. 2, lines 45-56; col. 4, lines 40-54 and col. 5, line 9 – col. 6, line 4.

Bishay does not teach *comparing relative changes in hue* and the relative weights depending, at least in part, on the difference in hue in one particular direction relative to the other. Instead, Bishay teaches using relative changes in intensity values (brightness) of neighboring pixels to detect an edge for computing missing color values using hue-weighted technique for a directional interpolation (a direction having a strong correlation or less relatively change). However, it is obvious that characteristic of an object in an image can be determined based on hue, brightness, **gradient of hue or brightness**, etc...as suggested by Bulman in col. 15, lines 30-34.

Therefore, it would have been obvious to one of ordinary skill in the art to configure the imaging system in Bishay to compare relative changes in hue for detection of characteristic of an edge and that the missing color values obtained as hue-weighted values of neighboring pixels would be based on the difference in hue value in one particular direction relative to the other in an alternative implementation over the difference in intensity (brightness) of pixels as suggested by Bulman.

Regarding claim 2, the combination of Bishay and Bulman would teach computing a color signal that includes relatively weighing the differences in hue by relatively weighing more heavily the difference in hue associated with the direction having a difference in hue less relatively for the particular pixel location (see Bishay, col. 6, lines 45-63 for the interpolation

using heavily weighted in hue in the direction where the particular pixel X belongs to). It should be noted that hue-weighted in other directions are zero.

Regarding claim 3, it is clearly seen in Bishay that the subsampled image comprises an image in RGB color space format including an R plane, a G plane and a B plane (Bishay; col. 4, lines 47-54 and col. 6, lines 45-63).

Regarding claim 4, Bishay discloses a CFA pattern that can be different pattern layouts that encompasses a Bayer pattern. See Bishay in col. 4, lines 31-35.

Regarding claims 5 & 6, it is also clear that the color plane of the pixel signal value at the particular pixel location comprises either R color plane, G color plane or B color plane (see Fig. 2 in Bishay, col. 4, lines 40-54 and note that location X is an example of Blue color plane, other Red and Green planes are also considered in the same manner) and that the two mutually orthogonal directions comprising the horizontal and vertical directions (Bishay, Figs. 2-6 and col. 5, lines 9-45); the particular color plane for the color signal value being computed comprising the G plane (as an example described in col. 5, lines 9-45, X is an G pixel and being computed for missing R and B color values).

Regarding claim 7, it is submitted that missing R color value at B pixel location is also performed in the same manner as described in the **exemplary** method for missing color values at G pixel location as described in col. 5, line 9 – col. 6, line 4 and col. 6, lines 30-63, wherein a

main diagonal (i.e., positive 45 degrees) and a secondary diagonal (i.e., negative 45 degrees) directions are used for the interpolation process.

Regarding claim 9, see the analysis of claim 7, wherein missing B color value at R pixel location is performed in the same manner as described.

Regarding claims 11 & 12, see the analyses of claims 5 & 6, wherein missing G color value at either B or R pixel location is also performed in the same manner as described.

Regarding claim 13, see the analysis of claim 1. Furthermore, Bishay teaches that the principle of the interpolation method as disclosed may be implemented in a computer program stored in the imaging device 10 (Bishay, col. 7, lines 60-64).

Regarding claim 14, it is clear that the instructions to be executed for interpolating color pixel signal values from a subsampled image in RGB color space format (see Fig. 7 for an algorithm of the interpolation process).

Regarding claim 15, see the analyses of claims 4 & 14.

Regarding claim 16, see the analysis of claim 1 and Fig. 1, col. 7, line 60 – col. 8, line 5 for an electronic circuitry adapted to process and interpolate pixel signal values.

Regarding claim 17, see the analyses of claims 3, 14 & 16.

Regarding claim 18, see the analyses of claim 4 & 14.

Regarding claim 19, see the analysis of claim 1 and Fig. 1, col. 7, line 60 – col. 8, line 5 for a computing platform adapted to process and interpolate pixel signal values.

Regarding claim 20, see the analyses of claim 3, 14 & 16.

***Allowable Subject Matter***

3. Claims 8 & 10 allowed.

The following is an examiner's statement of reasons for allowance:

Regarding claim 8, the prior art of record fails to teach or fairly suggest the combination of all limitations required in claim 8 that includes "...wherein the interpolation of a blue pixel signal value at a green pixel location is based at least in part on computed B pixel signal value levels for red pixel locations adjacent said green pixel location and also on existing blue pixel locations adjacent said green pixel location in a mutually orthogonal direction to said adjacent red pixel locations in the subsampled color image."

Regarding claim 10, the prior art of record fails also to teach or fairly suggest the combination of all limitations required in claim 10 that includes "...wherein the interpolation of a red pixel signal value at a green pixel location is based at least in part on computed R pixel signal value levels for blue pixel locations adjacent said green pixel location and also on existing

red pixel locations adjacent said green pixel location in a mutually orthogonal direction to said adjacent blue pixel locations in the subsampled color image."

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

**4. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nhan T. Tran whose telephone number is (571) 272-7371. The examiner can normally be reached on Monday - Thursday, 7:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Ometz can be reached on (571) 272-7593. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NT.

DAVID L. OMETZ
SUPERVISORY PATENT
EXAMINER